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1. The following English language journal issued by Svenska Aeroplan Aktiebolaget (Saab Aircraft Company) of Linköping, Sweden is on file in the CIA library:

   Saab Sonics
   Number 1
   January-March 1948

2. This journal contains pictures of some of the buildings of the Saab plant at Linköping, as well as pictures of management personnel and various aircraft produced by the company. Among the articles are a brief introduction to the company illustrating its development and manufacturing progress, a technical review of Saab progress, a discussion of a few aspects on the design of Saab Scandia Aircraft and an article by Erik Wilkenson entitled, "How Saab Developed a New Bomb Sight".

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SAAB SONICS

NUMBER 1

JANUARY—MARCH 1948

SAAB AIRCRAFT COMPANY • SWEDEN

SAAB SONICS

SVENSKA
AEROPLAN AKTIEBOLAGET
SAAB AIRCRAFT COMPANY
LINKÖPING, SWEDEN
Publisher: RAGNAR WAHRGREN
Editor: OVE SCHULZE

No. 1 JANUARY—MARCH 1948

CONTENTS:

Cover picture: Travellers in front of the Saab Scandia

(Photo: C. E. Rosenberg)

Classification summary for technical articles is to be found on the third page of the cover

Printed in Sweden by Oscar Isacsons Boktryckeri AB. Göteborg 1948

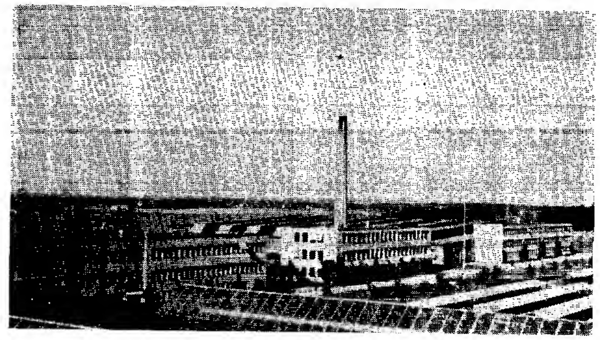
SAAB SONICS is a journal issued by Svenska Aeroplan Aktiebolaget (Saab Aircraft Company), the Swedish aircraft manufacturers. The journal, which was inaugurated in 1945, has hitherto been printed in Swedish only under the name of "Vingpennor". From now on an English edition will also be published, the first number of which we have pleasure in presenting herewith.

The purpose of "Saab Sonics" is to keep airminded people, both in Sweden and abroad, informed of our company's activities, developments and products. During the past years the name of Saab has become well-known in many parts of the world, particularly owing to our civil aircraft Saab Safir and Saab Scandia, which have flown in many countries. It will be the aim of "Saab Sonics" to maintain and strengthen these connections and to establish new contacts. We shall make every endeavour to render the contents of the journal instructive and interesting, and it is the ambition of the editors to justify the confidence in the name of Saab that has been shown in every quarter.

We thus hope that the journal will fulfil its purpose in its new form also and that it will be appreciated by all friends of Saab throughout the world.

Ragnar Wahrgren

Saab Aircraft Company



Some of the buildings of the Saab plant at Linköping

A brief introduction to the Company, illustrating its development and manufacturing programme, by Arne Krabbe, Saab Public Relations Manager.

The Swedish airplane concern, Saab Aircraft Company, now can look back on its ten-year existence as a period of such great expansion that the firm today represents one of Sweden's leading industries. Its operation has constantly increased, and now embraces the successful production of various types of aircraft.

The history of Sweden's aviation industry goes back more than a decade, however. As early as 1911 airplanes were designed in Sweden. The experience gained in the country at that time has been utilized and further extended by Saab. The latters immediate predecessor was Svenska Järnvägsverkstäderna at Linköping, where an aircraft division was established in 1930. This department, ASJA, was merged with Saab in connection with the transference of the firm's headquarters from Trollhättan in western Sweden to Linköping. Since that time Saab has operated plants of approximately the same ground area in these two cities, the operation running on parallel lines in both. In the matter of organization, the administrative and designing departments have been located in Linköping while only such offices as are necessary for running the factory are to be found at Trollhättan.

The economic development and constant expansion illustrate Saab's increased importance and productive capacity. On the establishment of the firm in 1937 a new aircraft plant was built at Trollhättan. The capital at that time was 4 million kr. At the same time ASJ's airplane factory at Linköping was enlarged, so that the two firms were practically of the same size at the time of the merger in 1939, when the share capital was increased to 13 million kr. The outbreak of the second World War impressed the authorities with the necessity of further expanding the domestic aviation industry. The Government therefore initiated negotiations with Saab for enlarging the plants and an agreement was concluded, the capital being again increased, this time to 21 million kr., which has been fully paid up. The agreement related exclusively to an increased production for the Air Force and did not include any stipulation that the management should be subjected to Government control. Saab remained a private company operating exclusively on private capital.

Up to this time Swedish airplane manufacturers had operated chiefly as licensees of foreign aircraft producers, and Saab originally worked on similar lines. From 1938, however, the Company began to design its own aircraft.

Present production is the result of experience gained during the initial period, but we can still regard our first original design, created in 1938, with pride—a single-engined bomber and reconnaissance plane, the Saab-17. This plane

Saab's public relations manager, Mr. Arne Krabbe

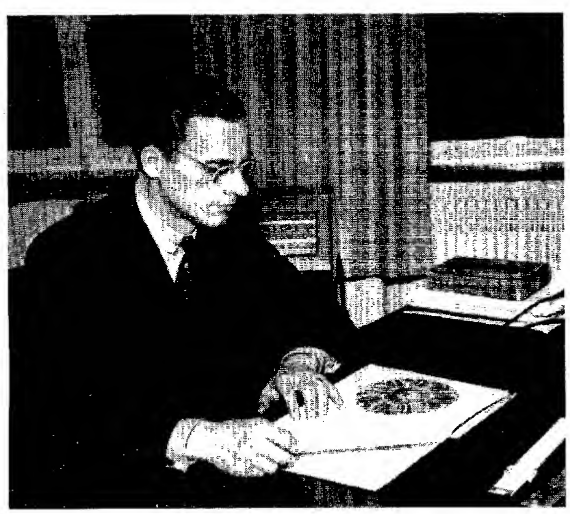
A Few Aspects on the Design of Saab Scandia

The Scandia's chief designer, Mr. Bror Bjurströmer, describes in broad outline how the Saab Scandia was designed—Special articles which deal in detail with the various units of construction of this plane will be published in later issues of the Saab Sonics.

Up to the year 1944 Saab Aircraft Company devoted its activities exclusively to the building of military aircraft. In that year, however, it was decided to take up the construction of civil aircraft, and the plans for the Saab Scandia were worked out.

This decision entailed very heavy investment of capital for a Swedish industry and consequently the costs for carrying out the project had to be carefully estimated. For the same reason the flying qualities of the airplane, its maximum weight, performance, operating economy, etc., were calculated in the greatest detail during the project stage.

The preliminary planning occupied some considerable time, the idea being to build an airplane for which the requirements would be of a nature entirely different to those called for in a military plane.



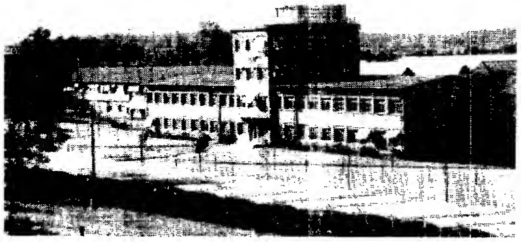
Mr. Bror Bjurströmer

We set out to build a twin-engined airplane of the smallest size that could be expected to find a market on the termination of the war when, as could be foreseen, demands for air transport would increase. Studies showed that good transport economy could be achieved with a plane seating 25–30 passengers. The plane should primarily be suitable for European traffic, i. e. for distances up to 1,000 km. but should also be economical in use over larger distances, where the traffic density would not justify larger planes. It will be easily understood that the longer the distance, the larger will be the plane, which is most suitable when considering the operation economy. There is of course further condition namely, that the demand for transportation must be great enough to permit the plane to be operated profitably.

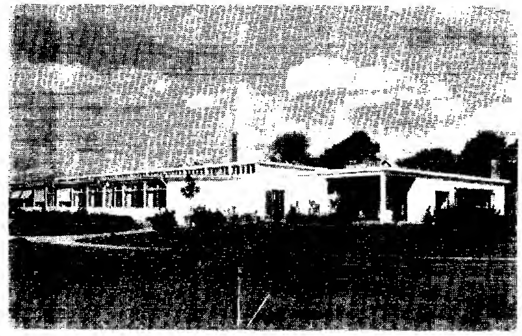
Fundamental requirements

The fundamental condition was that the plane should possess a high degree of safety in flight, as great, in fact, as technical knowledge could achieve.

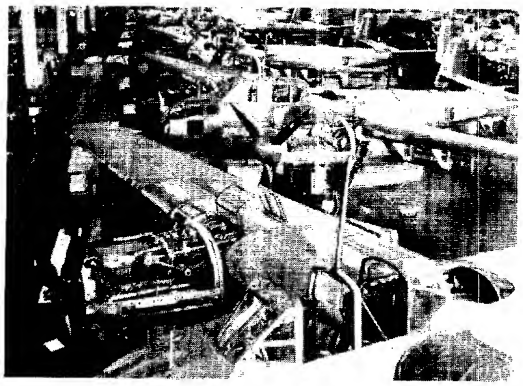
It is accepted as a general rule in aircraft design that it is desirable to raise the wing loading, firstly to increase the cruising speed, and secondly to obtain a reduced wing weight, i. e. greater useful load (pay load). But an increase in the wing loading not only raises the cruising speed but also the minimum flying speed (landing and stalling speed). For the Scandia, however, the minimum flying speed should not be



The administration buildings of the Saab plant at Trollhättan



Saab's light and airy restaurant at Linköping



A picture from the assembly shops at Linköping

has given excellent service for many years, and is still in active service in the Royal Swedish Airforce as well as employed for training purposes by the Imperial Ethiopian Air Force. Thus 16 Saab-17 machines were delivered by the Swedish Air Force to Ethiopia on Oct. 30, 1947.

Our next design, Saab-18, was once among the world's fastest twin-engined bomber planes. This plane has been produced in various versions and, similarly to the Saab-17, it has been the object of considerable attention abroad.

Complicated technical problems were solved by the firm in connection with the building of the Saab-21. This fighter plane with a pusher airscrew marked a milestone in our production, since this was our first design with a nose wheel gear a design which proved to possess such advantages that it is now the obvious choice for all new types. Test flights started in 1943, and the Saab-21 satisfied all expectations. Comparisons with contemporary designs abroad were also favourable to the Saab-21.

Military production and expansion by no means ceased after the war. Saab is continuously developing new types and has made considerable progress in the production of jet planes. Incidentally the first plane of this type flew its first test flight as early as 1947 and we are expecting much from a jet plane type now being designed.

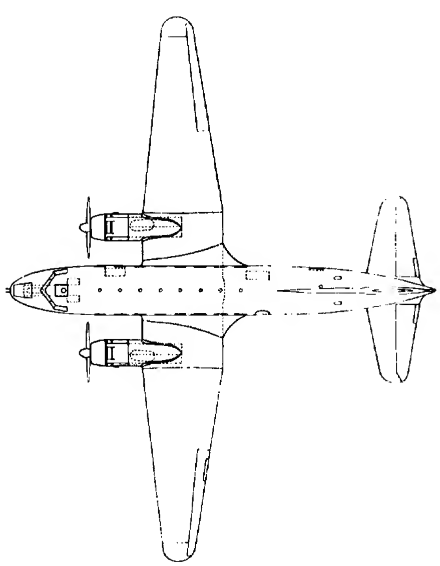
That is the general background of Saab's activities. During the years that we were building under licences and while we have been solving various problems connected with war production, the designing of civil craft has been maturing: experience has been gathered and utilized to the full extent on civil planes. The later success of these planes is of course a source of pleasure, but is scarcely a cause for surprise, since it merely fulfils our expectations. We are nevertheless proud of our little three-seater, the Safir, which has won a world record, and we are entitled to boast of the performance achieved by Saab Scandia our twin-engined traffic plane for 24--32 passengers.

Our products will be described in more detail in this and later issues of "Saab Sonics" and the illustrations accompanying this article are therefore only intended to convey an idea of our factory plants. Both in Linköping and Trollhättan they are fully up-to-date and compare favourably as far as size is concerned, with similar plants in other parts of the world. As I have mentioned above, the two factories are of much the same size as far as construction above ground is concerned. At Linköping, however, we also have an underground factory, an impressive plant which will be the subject of an article in the next issue of our publication.

Beginning in 1948, airplane production will be concentrated at Linköping while our latest creation, a little four-seater passenger car a wind tunnel-tested, stream-lined beauty will be produced at Trollhättan. In the future Saab therefore can meet the demand for a modern motor car in the small class and is also well prepared to carry on its successful production of airplanes.

greater than that adopted for airplanes before the war, which are still in use. These planes were designed some ten years ago, but the technique of take-off and landing has not been developed to such an extent as to permit any considerable increase of landing speed, or in other words, of the wing loading. It was nevertheless possible to increase the wing loading on the Scandia by 30- 40 % thanks to advances made in the sience of aerodynamics. Any further increase above this would entail a reduction of safety, and this latter being the essential requirement for a passenger plane, no further increase could be justified however attractive it might have been from the point of view of operating economy.

Thus, when the pay load, the flying distance and the wing loading had been determined, the most favourable cruising speed and the necessary cruising engine power could be calculated. In these calculations some adjustment had to be made to available engines. It was also possible in the preliminary stages to calculate take-off and landing distances and to determine the general design, paying due regard to the further development of the type. The values obtained also enabled operating economy calculations to be made.



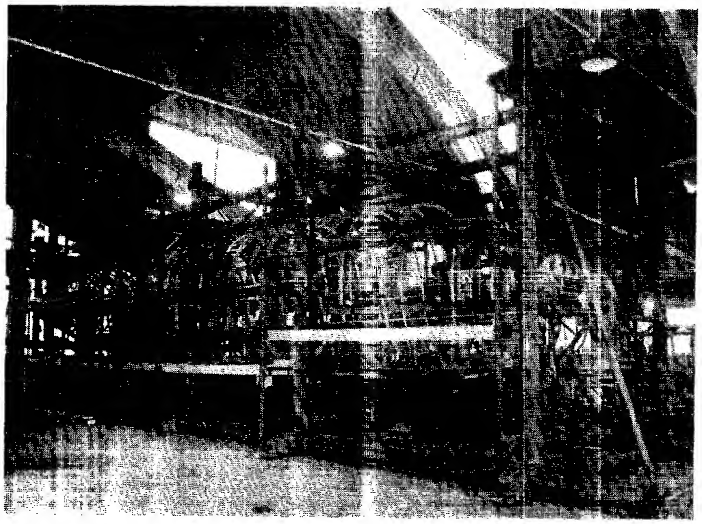
Basic design

The basic calculations confirmed the Scandia's improved performance in relation to other airplanes. The extensive project was thus justified and we could begin to work out the details of the design.

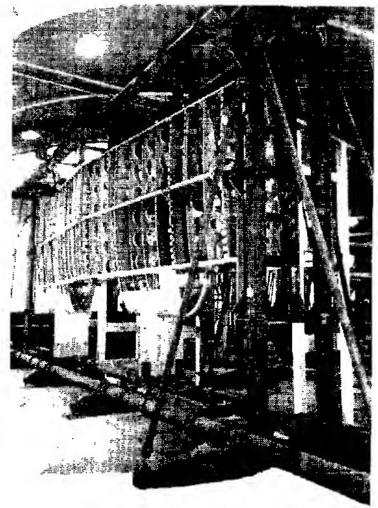
Attention was of course first devoted to the design of wings and control surfaces, with the utmost regard to the requirements for maximum safety. Aerodynamically, the flying safety for a transport plane may be limited to its flying qualities at low speed in contrast to planes of greater speed, especially military planes, where the high maximum speed is as great a problem. As mentioned above, the wing loading for the Scandia was chosen somewhat low (163 kg/m^2), which, in conjunction with the use of efficient landing flaps, gave a low minimum flying speed. In order to maintain full control and stability down to these speeds, the wing formed the subject of careful study, mainly with a view of giving it such a form that the stall would be favourable, so that there would be no tendency to roll during stalling. The results of these studies have been described in Teknisk Tidskrift No. 46, 1945, in an article by Mr. H. E. Löfkvist, " Stalling and Rolling Stability in Airplanes ". The wing span was determined by the requirements of rate of climb with one engine, and well-known NACA-sections were selected for the wing. Slightly higher cruising and maximum speeds might have been achieved with " laminar flow "-sections, but on account of the requirements for low landing speed and good " bad weather " qualities first attention was given to the demand for safety. " Laminar flow " sections are likely to be sensitive to icing and require extreme care in maintenance if the boundary layer is really to be laminar, i. e. if the resistance is to be kept low.

The Scandia has been designed as a low-wing airplane, although the free-view of the passengers might have been more favourable with a high-wing airplane. A lower landing speed is obtained, however, with a low-wing plane, since the wing flaps can be made continuous, and the wing

Three-view drawing of the Scandia, approximate scale 1: 360.



The fuselage being produced in a jig of impressive size



The structural design of the wing with three spars appears from this picture

comes closer to the ground. In addition, the structural weight will be less, and there will be greater safety in forced landings, especially on water. It might possibly be argued here that there must never be any forced landings with a traffic plane, but unforeseen events must be taken into account if safety is to be a primary consideration. It is also probably true that there is a greater feeling of security when sitting above rather than below the wing.

It is perhaps unnecessary to discuss the type and arrangement of the landing gear as it can now probably be taken for granted that it should be of the tricycle type. The nose wheel gear will be somewhat heavier than the tail wheel gear, but increased safety and comfort in take-off and landing, and in taxiing more than counterbalances the sacrifice of weight. The fact that all landing legs retract forward may not be as easily recognized as an advantage from the point of view of safety. In unforeseen situations, however, the landing gear must be extended very rapidly, which becomes possible when the gear falls out into the extended position by its own weight and is drawn back into the locked position by the force of the air, which amounts to about 100 kg on each leg. The force of gravity and the air stream also offer the most reliable emergency arrangement if the hydraulic system should fail to function satisfactorily.

The longitudinal extension of the fuselage will depend upon the size of the wing surface and the wheel base of the landing gear (the distance between the centers of nose wheel and main wheels). The length of the fuselage having been thus determined, it proved convenient to place eight rows of seats lengthwise. A maximum of four seats could be arranged side by side, and thus allowing a maximum number of 32 passengers to be carried (for short distances). For longer travel, where the passengers comfort required more space, three slightly wider seats were placed in each row, providing seating space for 24 passengers. Space should also be available in the fuselage for about 10 m³ of cargo. Crew space should preferably be very ample and allow room for four occupants, besides which there must be room for a lavatory, pantry and cloakroom.

The engines should have an economic cruising output of about 750 BHP and about twice as much for take-off. We chose the American Pratt & Whitney engine Twin Wasp R-2000 with a take-off power of 1450 BHP. This is a 14 cylinder, air-cooled, double-row radial engine. Later on, however, the Scandia will also be equipped with engines of the Twin Wasp R-2180 type, which has a normal take-off power of 1650 BHP. By the injection of a mixture of methanol and water the take-off power can momentarily be increased to about 1800 BHP. We gave preference to the air-cooled type of engine, because at present it can be regarded as more reliable, lighter, easier to install and maintain than a liquid-cooled engine. The airscrews are Curtiss-steel with electrical operation for constant speed and synchronizing. They are wide blade airscrews to give greater thrust at take-off.

The airplane was to be equipped with modern instrumentation for flying and landing. It was also to have radio receiving and transmitting equipment, a direction finder and automatic pilot. It should meet all demands for performance, strength and other general requirements according to the U. S. Civil Air Regulations, which were chosen on account of the fact that the modern international regulations which are being worked out after the war are not yet completed. The proposed ICAO Regulations vary very little, however, from the U. S. Regulations now in force.

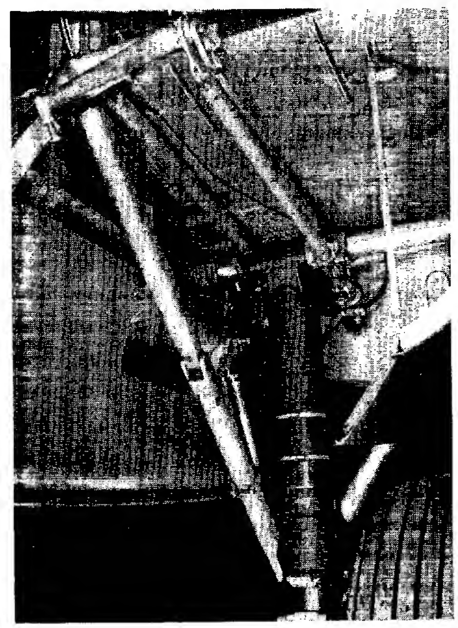
Final design

After the preliminary conditions had thus been worked out, the details for the aircraft could be designed. The work was started on the wing. First we had to determine what system of design would prove most advantageous, i. e. the number of spars, and whether to use stringers or corrugated sheeting. The result was the three-spar wing which gave the most uniform stress distribution both statically and with regard to fatigue. Stringers and corrugated sheeting were approximately similar in value, but stringers were chosen on account of the simpler production methods.

The wing is built up of three longitudinal spars and transverse ribs. It consists of a center section and outer wings connected by bolts immediately outboard the engine nacelles. Short, bolted wingtips complete the outer wings. The wing spars have riveted flanges and the ribs are of pressed sheet. The ribs are spaced about 350 mm apart. Between spars the shell is reinforced by stringers about 100 mm apart. There is a channel for heated air in the leading edge of the wing which has been reinforced in the direction of flight. The trailing edge carries wing flaps and ailerons.

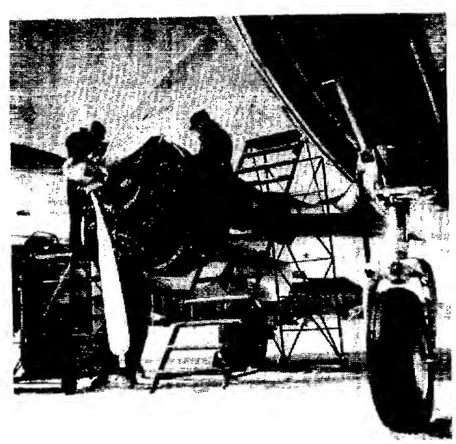
The ailerons are of a conventional Frise type, and equipped with trim tabs. The wing flaps are of the slotted type, which means that when the flap is lowered, the link system for bearings is such that the flaps simultaneously move backward to form a slot between the wing and the leading edge of the flap. This flap is simple in construction and maintenance and gives the wing a high maximum lift, which has been measured in flight to about 2.5. The wing flaps are hydraulically operated and have one cylinder each, but they are also linked together mechanically.

The fuel tanks are installed in the outer wings



Details of the left main landing gear

The Scandia's cargo space in the tail



The nose wheel, the engine installation and the wide-blade airscrew on the prototype

immediately outboard the nacelles, and are suspended in such a way that they are not affected by the deformation of the wing.

The engine nacelles which are riveted to the wing are built up with frames, longerons and cover sheet. The nacelles only carry the engine installation, as the main landing gear is attached directly to the wing spars. The shape of the nacelles has been adopted to that of the engine and the air inlet for the carburetor and oil cooler which are mounted under the engine.

The shape and structure of the tail are conventional, with fixed surfaces entirely of metal and the control surfaces built on metal frames with a fabric covering. Apart from the usual requirements for stability, the size of the tail has been determined by a number of other conditions. In a nose-wheel aircraft good control of the plane along the transverse axis is essential, so that, when the speed is considerably below take-off speed, the nose wheel can be lifted or lowered easily, and consequently the control forces must be moderate even when the elevators are fully applied. In view of this requirement the elevator balance was subject to special study in the wind tunnel. This applied also to the rudder, i. e. the pilot must be able to keep the plane on the course at take-off speed with one engine inoperative. Thus in this case, too, the control forces had to be moderate when the rudder was fully applied.

The landing gear, wing flaps and wheel brakes are hydraulically operated. The working pressure of the hydraulic system is 70 kg/cm² which is produced by a gear pump driven from each engine.

Anti-icing protection is obtained by allowing warm air to flow through the leading edges of the wing, the stabilizer and the fin, the air being heated in surface combustion heaters.

The fire alarm system consists of super-sensitive indicators installed in the engine and cargo rooms. A number of carbondioxid containers have been installed for fire extinguishing.

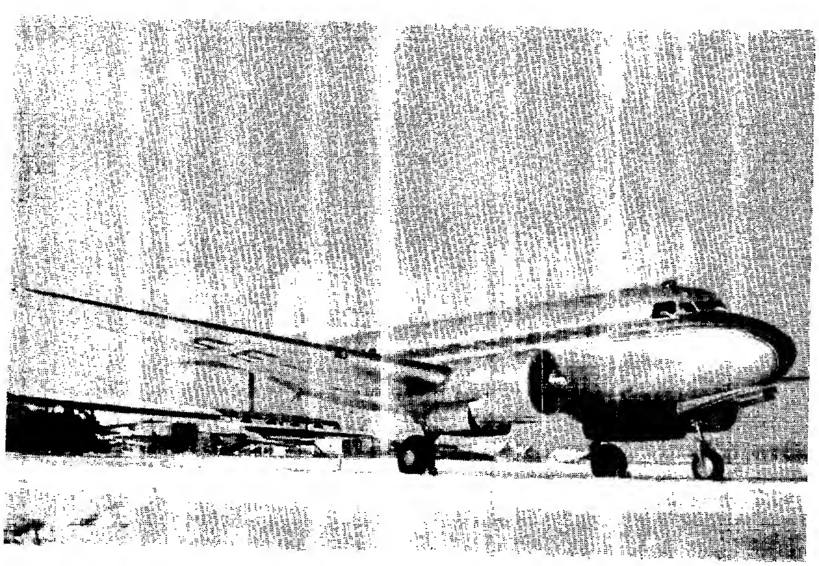
The first test flight

with the Scandia was made in the middle of November, 1946. Since then testing flight has been continued according to schedule and the results have excelled expectations in every respect.

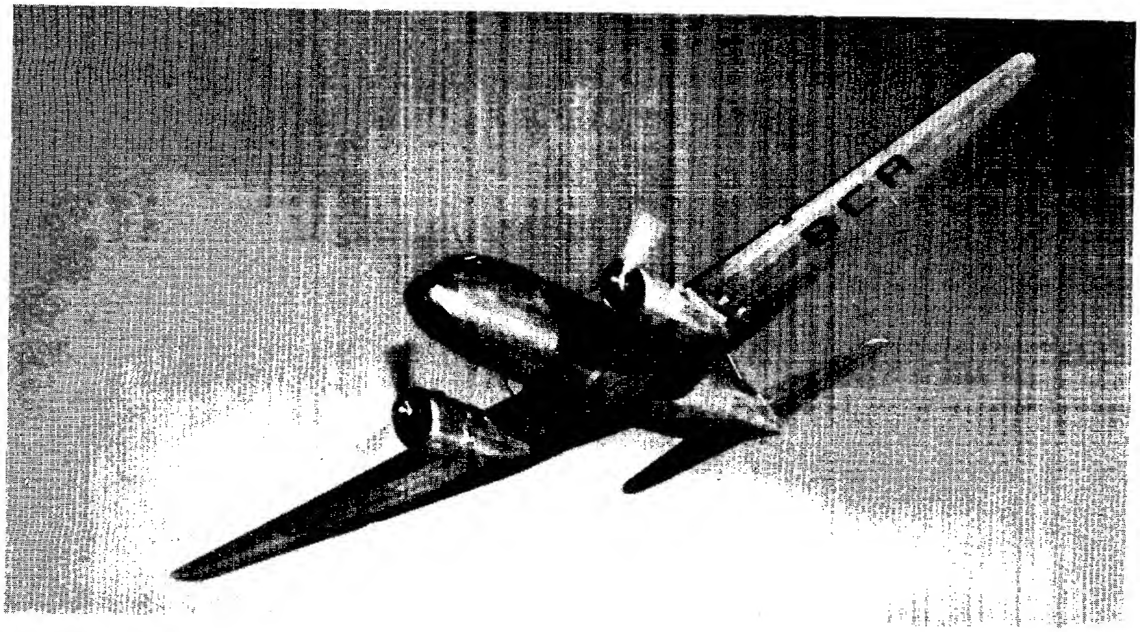
The economic cruising speed at an altitude of 3,000 m has been measured at 360 km/h which is better than expected from the first estimates. This will mean that with the R-2180 engine the economic cruising speed will be close to 400 km/h.

Maximum flying weight which is determined by the plane's rate of climb on one engine with the landing gear extended is 14,000 kg, which is also better than expected from estimates. The maximum take-off weight with R-2180 engine is 14.700 kg.

Flying qualities which are much more difficult to predict by calculations have proved to be extremely good. Our efforts to achieve good stalling and single-engine characteristics in the design have surpassed our most optimistic expectations. The general verdict is that the Scandia combines good performance with a high degree of safety in flight.



The prototype Scandia ready to take off



The Scandia in the Air

Captain Claes J. Smith piloted the Scandia on its maiden flight and during subsequent test flights. In the following article he describes the plane's behaviour in its proper element.

It is very natural that the test pilots of an aircraft factory have not had many opportunities during the period of more than seven years that has elapsed since the outbreak of the second World War to sit at the controls of a civilian airplane. The aviation industry, in Sweden as elsewhere, was called upon to strengthen the nation's armed forces, and was therefore obliged to specialize in the production of military planes.

It was quite a thrill therefore to settle in the pilot's seat of the Saab Scandia and get the "feel" of a cabin in which comfort was an important feature in the design. In the military planes this factor has always given way to demands for a maximum of military efficiency. It was often something of an acrobatic feat for the fur-clad and parachute-equipped pilot to enter his military plane on account of the numerous but necessary service devices for firing, bomb release, photography, etc. The absence of all such equipment in the Scandia enhanced the lasting impression of unusual cleanness.

The practical arrangement and spaciousness of the pilot's cabin are details which impress even the veterans of traffic flying. One of ABA's younger pilots expressed his feelings thus: "This is something very different to the old DC 3", words which made me recall the time when as a night mail pilot, I exchanged the barely covered cockpit of the Junker F 13 for the comfortable chair of the W 34; when the Ju 52 was considered to offer unheard of luxury; not to mention the feeling of reverence with which I took my place as second pilot in ABA's new DC 3 "Örnen".

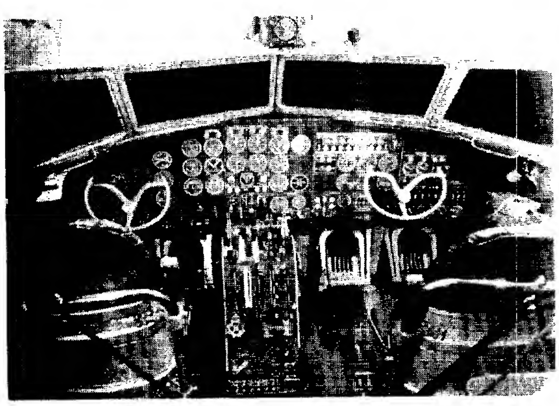
A particularly pleasing feature in the Scandia's cockpit- apart from the logical arrangement of instruments, the concentrated controls and the "roominess" -is the fact that the pilot has his crew within easy distance. Any pilot appreciates speaking directly to his wireless operator or flight engineer instead of first having to call them on the telephone. On the other hand, the Scandia's telephone is a distinct asset for contacting the air hostess instead of having to ring for her as in the old method.

The first flight with the Scandia naturally involved much less of a sensation at least

for the crew than similar flights with the Saab-18 or Saab-21. The latter in particular was the somewhat extreme result of new and untested designing principles. Aerodynamists and other experts experienced some difficulty in predicting with any certainty how it would behave in the air. The Scandia, however, although an advanced product, was a development of designs that had already been tested. This, by the way, is probably the only correct course to adopt in order to adhere strictly to the air traffic's essential demand for 100 per cent safety. Before the flight the aerodynamists predicted that the elevator would feel loose and that banking would be heavy. The flight confirmed this in full, which actually fostered greater confidence in their methods and knowledge than if perfect results had been achieved.

The first flight lasted for some 20 minutes. At the time of writing the plane has been in the air for about 160 hours. In the meantime we have been able to acquire a good idea of its qualities. I have been informed that the designers made it a leading principle that the Scandia should be as easy to handle at low speeds as the now legendary Ju 52. I believe that everyone who has flown the Scandia will gladly testify that this aim has been achieved. Anyone who has flown modern big military (or even civilian) planes will derive a thrill from flying such as is possible with the Scandia at a speed of 110—115 km/h while still maintaining complete control of the plane. Unless one has flown a Saab Safir earlier, it is difficult to believe in such a possibility except in a helicopter.

Even with fully developed stalling, the qualities are unusually good. Stalling occurs relatively slowly and straight ahead with neutral rudder. Stalling is preceded, as it should be, by light but unmistakable vibrations from the tail surfa-



The Scandia's cockpit

Captain Smith in the Scandia's pilot window

ces. Tuft observations have shown that the good stalling qualities are due to the fact that stalling begins at the roots of the wings while the air flow at the tips is laminar to the last moment. The fact that the plane can be controlled at all at speeds as low as 110—115 km/h may probably be ascribed to the fact that the wing loading has not been allowed to exceed a higher value than is compensated by the improved wing section and shape as compared, for instance, to the Ju 52. In contrast to similar foreign airplane types in which the wing loading often reaches the same values as in military planes of rather extreme types, the wing loading of the Scandia is not more than 163 respectively 172 kg/m².

These qualities in conjunction with a considerable surplus output in take-off, create a feeling of safety to which great importance must be attached. This is especially true when one calls to mind the great number of crashes which have occurred in connection with take-offs.

Engine failure on a twin-engined airplane implies a reduction by 50 per cent of available output in addition to increased resistance due to the unsymmetric tensile forces. Single-engine flying has therefore been subjected to particularly exhaustive studies, and the Scandia has amply satisfied the high expectations in this respect also. With one engine cut off and without feathering its airscrew, the airplane with only moderate counterbanking can be kept on a straight course with a slack rudder without any retrimming. After the airscrew has been feathered scarcely any trim change at all is noticeable. It is doubtful whether it is possible to make turns with more than 60° inclination toward the feathered engine as freely with many other similar airplane types.

Contd. on page 21

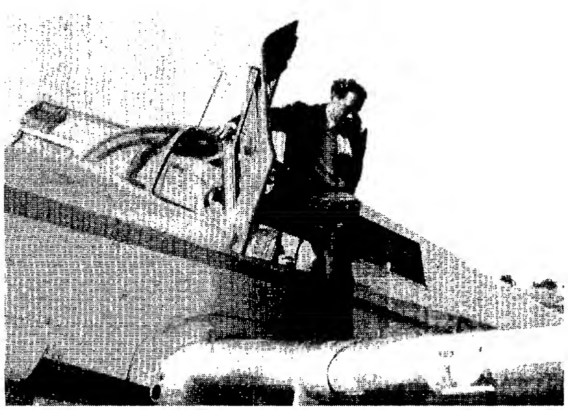
Saab Receives A Distinguished Visitor

Colonel Bader, nearest to the camera, in the Safir together with Lieutenant Olow

Late last summer Saab was visited by Colonel Douglas Bader—the well-known British fighter pilot of the second World War. Colonel Bader was in Sweden as the representative of Shell aviation petrol service, and needless to say, he made the trip here by plane in a Proctor flown by himself. His passengers were Mrs. Thelma Bader, his wife, and Clarence Lejdström, Director of Svenska Shell. When the Proctor landed at Saab's field its original destination had been Stockholm, but Col. Bader had heard so much about the Safir from Saab, that he wished to test its superb qualities for himself in a test flight.

And a test flight duly took place, with one of Saab's test pilots—Lieut. Olow as "second pilot" and Mrs. Bader as a passenger in the rear seat. The young officer flew the Safir through all its paces and his verdict during and after the flight was very enthusiastic. He only regretted that the present exchange situation rendered it difficult to introduce the plane in England, where, he was sure, it would otherwise find a good market.

Lieut. Olow has related an interesting episode from the test flight. In braking after landing, Colonel Bader experienced some difficulty with the brake pedals. He has protheses for both legs, and the position of the pedals is such that his feet could not obtain a firm hold. In order to brake, therefore, he was obliged to hold his legs on the pedals with his hands rather a unique method of braking which was made possible owing to the Safir's nose wheel. A plane conventionally equipped with a tail wheel would certainly not have behaved as satisfactorily without hand control.



It is hardly noticeable that Colonel Bader has artificial legs, when he jumps out of his Proctor plane on arrival at Saab

Colonel Bader has a long and eventful career behind him as a pilot. His experiences in the air would provide abundant material for any writer of thrillers. As early as 1931 he lost both legs in an air accident, but undaunted, he carried on as a flier after his recovery. During the war he was a fighter pilot and soon achieved fame as the result of numerous air victories. In the summer of 1941 he was shot down over Germany and taken prisoner. In the crash landing one of his protheses was destroyed; in appreciation of a brave opponent, however, the Germans gave permission for a British plane to provide a substitute limb by parachute.

Shortly afterwards Bader managed to escape. He was recaptured, however, and spent the remainder of the war in a prison camp.

The fact that he is a cripple is scarcely noticeable. He moves about freely and even dances and participates in sports. Golf is his favourite sport and during his visit to Sweden he took the opportunity of playing on the Tylösand golf links in preparation for the Danish Golf Championships.

The Colonel also enjoys playing tennis and won a match at Båstad, which is an eloquent testimonial to his agility.

From Saab, Colonel and Mrs. Bader flew on to Stockholm, from which city they subsequently returned to England.

Saab Prodı

Saab Safir

The jet propulsion fighter Saab-21R

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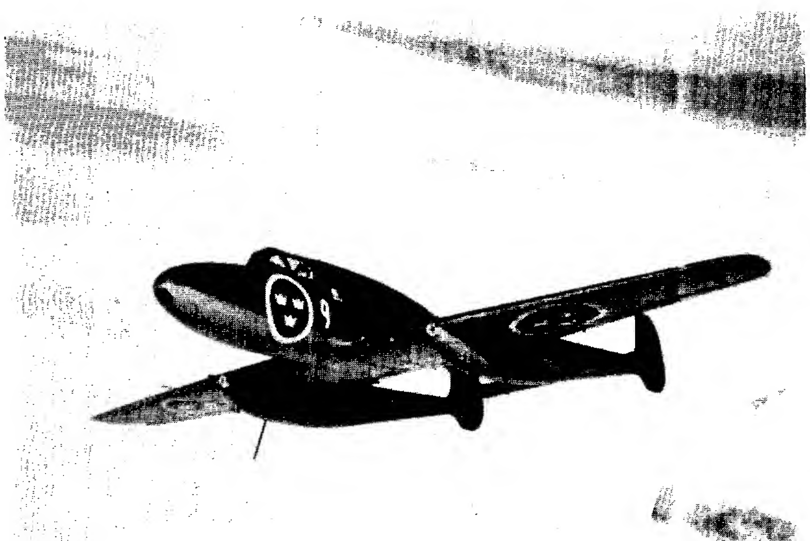
Saab Scandia



The pusher fighter Saab 21 A

The powerful nose section of the Saab 18B bomber

A Technical Review of Saab Progress

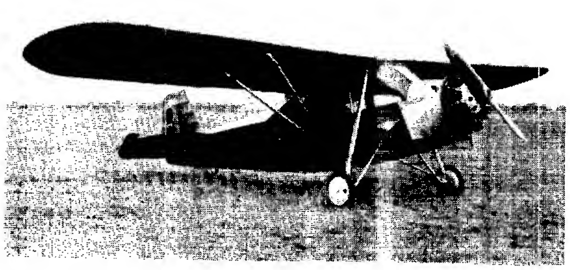
by Major Elis Nordquist, Technical manager of Saab

Major Elis Nordquist, Technical Manager

Aircraft design and manufacture have advanced so rapidly that today it is scarcely out of place to refer to "the good old times" when discussing airplane production in the early '30's. Notwithstanding the steady progress made it might not be amiss to glance back, and record the events of the past years before memories fade into oblivion.

The design and production of aircraft were begun at ASJA (AB Svenska Järnvägsverkstädernas (ASJ) Airplane Department) at Linköping about 1930. This concern's first design, the Viking, was a high-winged sports plane seating three in an entirely enclosed cabin. The speed was approximately 165 km/h. Only two units of this type were built, one of which had a long life and earned laurels as a reporter plane for the Stockholms-Tidningen, until at a venerable old age it landed—with floats— on a field and was never repaired.

At about the same time the Royal Swedish Air Force commissioned ASJA to design a training plane, later known as the Ö 9. Of this type ASJA built one land plane and another with floats. It would probably be very difficult to find an uglier or clumsier plane than this one proved to be, but the blame should not be placed entirely on the designers, since the specification they had to follow did not allow much scope for the introduction of clean lines and beauty in the design. There was no series production of this type.



The Viking I, the first all-Swedish design from AB. Svenska Järnvägsverkstäderna

ASJA required work for their factory, however, but as it was quite clear that the market would be very limited and that the costs for design and development would never be covered, the company declared its willingness to operate under licences from foreign firms. As a result of this orders were received for the production of 25 trainer planes of the Raab-Katzenstein-Tigerschwalbe type. In the Royal Swedish Air Force these planes were known as the SK 10. Production was completed in the years 1932—1934.

In those years aerobatic flying played an important part in the training schedule; *inter alia*, the inverted spin was very enthusiastically practised. After a few fatal accidents the direct cause of which was found to be that the pilots had not been able to pull the SK 10 out of an inverted spin, thorough investigations were undertaken in order to discover the reason. I doubt whether any other airplane in the world has been put through so many inverted spins as the SK 10, and it is something of a miracle that Colonel Bengt Jacobsson of the Royal Swedish Air Force has not sustained permanent giddiness as the result of all the inverted spins with varying centres of gravity, which he carried out for months on end. To the best of my recollection it was never satisfactorily explained why the plane on certain rare occasions could not be taken out of the

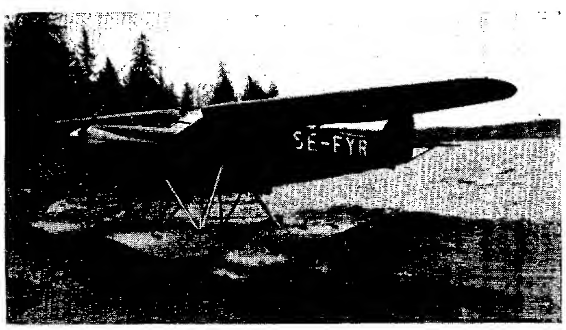
inverted spin. In my opinion the result would probably have been the same if any of the airplanes of that period had been tested to the same extent. The flying qualities of the SK 10 were regarded as relatively good, however, and the type was used in the Air Force for several years, although it had a somewhat sinister reputation as evidenced by the various nicknames applied to it, such as "the Death Machine" which, incidentally, was one of the milder terms used.

In 1934 the first series production of military planes was begun by ASJA. In that year a small number of fighters was delivered to the Air Force. They were of the Jaktfalken type designed by the Svenska Aero in Stockholm, a company which had been taken over by ASJA. This plane had a Bristol Jupiter engine of about 500 HP, a speed of about 300 km/h and great manoeuvring flexibility. It ranked with the best foreign contemporaries.

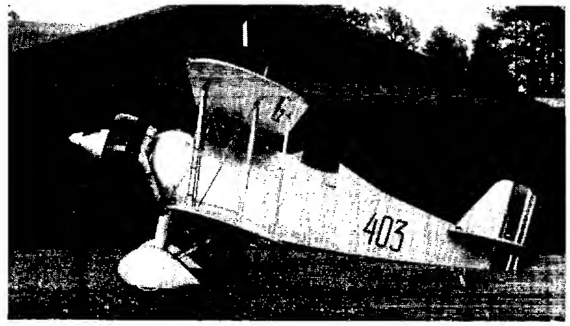
ASJA had not permanently abandoned its plans for designing types of their own, however, and in 1934 they completed the Viking II which was sold to the Stockholms-Tidningen and given the name of "Sefyr". Often seen on foreign aerodromes and familiar to everyone in Sweden on account of its news and film flights for its owners, the Stockholms-Tidningen and the leading Swedish film company, Svensk Filmindustri, it was certainly a subject for pride. Few privately-owned airplanes have probably had such a long life as the Viking II notwithstanding all its exacting assignments, sometimes on wheels, sometimes on skis and often on floats. It is a cause for regret that a suitable market could not be found for this type and that, therefore, only one was built.

The Viking II had a Gipsy Six engine of 200 HP, a maximum speed of 235 km/h and could take three passengers besides the pilot.

In the period 1935–1937 ASJA produced a



The four-seater enclosed cabin aeroplane, Viking II



The fighter "Jaktfalken", Swedish built, here in Norwegian version

few aircraft of British design under licence of the De Havilland Tiger Moth type. In the Air Force this plane was known as Sk11A; it had a 130 HP Gipsy-Major engine and a top speed of 175 km/h. It replaced the older Moth Sk9 as a training plane and certainly gave long and faithful service. The type is still in use in many places in Sweden for towing anti-aircraft targets or gliders.

As early as 1933 the Swedish Royal Air Force had acquired a licence for building the famous British airplane Hawker Hart. The Air Force devoted much time to the translation of drawings and slight modifications of the design, but eventually ASJA received an order for twelve planes of this type, which was later increased by another six. This was considered a very substantial order at that time.

The Hawker Hart, a two-seater, having a Bristol-Jupiter engine, was used as a dive bomber and to some extent as a reconnaissance plane. When it first made its appearance in Great Britain it was regarded as a miraculous production, and undoubtedly it was a fine plane. Its speed was greater than that of any of the fighter planes then in service in Great Britain. Unfortunately, however, it had already become somewhat out-of-date by the time it was taken up by the Royal Swedish Air Force. This points clearly to the necessity of designing machines within the country if it is desired to keep ones material up-to-date.

The B 4, as the Hawker Hart was called in the Air Force, was equipped with a Swedish-built Bristol/Nohab My VII engine of 580 HP giving a top speed of 270 km/h.

From 1936, when an expansion of the Air Force was decided upon, the outlook for the Swedish aviation industry to work independently of foreign design improved considerably. The Air

Force at that time set the ASJA a hard task when, as a condition for placing an order with the firm for 20 Focke-Wulf Stieglitz', it was stipulated that delivery must be completed in the same time as that within which the machines could be obtained from the original licensors. The ASJA received drawings and part of the tool equipment late in January, 1938, and began delivery in August the same year. And this was done in spite of the fact that the delivery of the instruments which were to be mounted in the planes was nearly a month late! The plane was equipped with a Siemens Sh14 engine giving a top speed of 175 km/h, and it is still serving as a training plane.

It was not considered sufficient for the pilots merely to learn the elements of flying, however. They also had to master the control of the heavy planes which the Air Force was purchasing in increasing quantities. An intermediate type was found necessary and in 1938, the Air Force acquired the right to build the American "North American NA 16-4" which in Sweden was known as the Sk14A. In this plane a new structural method was introduced, the wings of the plane being made in stressed skin construction which is now common practice. The Sk14A, having an unusually powerful engine for a training plane (the 445 HP Wright Whirlwind) and therefore a comparatively high speed (270 km/h) was excellently fitted for its task. It remained on the production programme for six years.

The Aircraft Department of the ASJ gradually required more and more space and its separation from the rest of the firm was deemed desirable. The history of this separation does not fall within the scope of this article however.

In 1936, which, as explained above, marked a turn in the history of the Royal Swedish Air Force, it was decided to establish a fleet of heavy bombers. The Air Force chose the German twin-engined bomber, Junkers Ju 86K, which in Sweden was known as the B3. Production in Sweden of this type was considered desirable and was started in 1938 at Saab's newly-built factory at Trollhättan. The plane was considered fully up-to-date with a speed of 375 km/h from its Bristol/SFA My XXIV engines of 930 HP. It was faster than the fighters in service in Sweden at the time. The B 3 which is still seen in the air occasionally was a stressed skin design and from then on this has been the dominant type of construction at Saab.

Saab also contributed to the increase in the

The first of Saab's own designs the dive bombing and reconnaissance aircraft Saab-17

number of light bombers by building the American Northrop 8A-1 for the Air Force. This plane, known as the B 5 within the Air Force, was far more streamlined in design than any preceding types and in its general outline was a very beautiful plane. It was fitted with the same engine as the B 3, the speed being about 330 km/h.

It will be realised that in the pre-war years efforts both at ASJA and at Saab were chiefly devoted to production under license. The idea of producing from their own designs was always kept in mind, however, and as the international situation became more and more complicated it was clear to leading Swedish aviation circles that Sweden would not be in a position to maintain a modern air force based on foreign designs.

In recognition of this fact Saab set to work on its first original design which, according to the specifications received from the Air Force, was to be a reconnaissance plane. It was later decided that the plane should also be produced in the form of a bomber. In 1941 a sensation was caused—for it cannot be denied that it was a sensation—when news was first published concerning the Saab-17, or B17 and S17 as it was called in the bombar and the reconnaissance types, respectively. This plane is fitted with three different types of engines: the Pratt & Whitney/SFA TWC-3 of 1,050 HP, the Bristol/SFA MY XXIV of 980 HP, and the Piaggio P XI RC40bis of 1,050 HP.

When reports of the Saab-17 were published the design of the next airplane was already far

Contd. on the third page of the cover

How Saab Developed A New Bomb Sight

During the second World War Saab not only produced bombers but also increased their fighting efficiency by equipping them with a precision bomb sight of an original design, based on a new bombing method. The author of this article, Dr. Erik Wilkenson, brought forward the fundamental ideas of this new bombing technique in 1940, and was then responsible for the design, development, and manufacturing of the new bomb sight. The theoretical problems of dive bombing have earlier been examined by the author under the title "Dive Bombing", which treatise was accepted 1947 as the first doctors theses on an aeronautical subject at the Technical University of Stockholm. The story told here is therefore devoted to some historical and engineering views on the subject.

There is a general desire in air bombing to achieve the greatest possible precision in bombing without exposing the bombers to too great risks from the active air defence, fighter planes and anti-aircraft artillery. In regard to the military conditions, however, the problem varies, in accordance with the size of the country, its military position and national policy. A great power often primarily needs heavy bombers with a wide operational radius in order to attack distant targets. Such bombers are forced to release their lethal loads from high altitudes in order to get beyond the reach of the anti-aircraft defence, but in so doing their bombing accuracy is reduced. All efforts to increase accuracy result in very complicated instruments and automatic pilots.

For a small country such as Sweden the aim is quite different. Thus the Swedish Commander-in-Chief, General Jung, in his proposals for the defence, of March, 1947, points out that the activity of the air forces apart from fighter defence should comprise "attacks against an invading enemy and his advance bases." It is obvious that comparatively small medium bombers are suitable for such tasks. By using smaller airplanes it will also be possible to maintain a greater number on the limited appropriations alotted for this purpose. Regard must also be paid to certain special factors; the potential invader will probably have mastery of the skies, and the direct military objects as mentioned above will often be small (and mobile) and therefore difficult to hit. But smaller bombers are more easily manoeuvred than the heavy long distance bombers, and this gives them some chance of escaping the ground defence without forcing them to high altitudes for bombing.

Dive bombing

The points of view set forth above indicate that in Sweden there have been special reasons to study precision bombing from aircraft operated on mobile tactical lines. In point of fact the Swedes have been pioneers in dive bombing since 1932. The procedure then worked out was the following: The pilot, who is also the bomb releaser, heads for his target in an almost vertical dive from an altitude of about two thousand meters, releases his bombs from an altitude of 600 to 1,000 meters, and then pulls out of the dive, sometimes quite abruptly because of the proximity to the ground. The bombs continue towards the target on a very straight course. A high degree of accuracy can be obtained with relatively simple sights, on account of the fact that the variations in the so-called release factors (dive angle, release altitude, release speed, etc.) do not play a very important part. On the other hand dive bombing makes great demands on the pilot's skill, especially when manoeuvering into the correct position for diving.

New bombing method

As planes became more rapid and heavier, dive bombing was rendered more difficult. The nearest approach to solving the problem was found to lie in the reduction of the diving speed by dive brakes. But these did not eliminate other disadvantages and thus the idea originated to try

an entirely different bombing method, thereby facilitating the task of the pilot and making bombing more effective from the military point of view.

When diving in medium steep angles, the airplane does not increase its speed so rapidly (even without brakes) and the need for altitude above the target is appreciably reduced. Thus the pilot can perform a dive in a 40° angle much more easily than in an 80° angle, but there are difficulties of another kind. The curvature of the bomb path increases considerably and the influence on it of the dive angle, the release altitude and the release speed become more critical. Even at a short distance from the target the curvature will be so great that the pilot of a conventional single-engined bomber is frequently unable to see the target at the moment of bomb release. In an airplane the visual range is limited from 5° to 10° downward in the forward direction while the target line may have to lie 10° or even 15° downward at the release at a safe distance from anti-aircraft fire.

In order to facilitate bombing in shallow or medium dive angles it was therefore suggested at Saab early in 1940 that bombing should be effected in the following manner: the pilot dives in a moderate angle straight for the target, sighting with the same fixed sight that he uses for the forward firing weapons. After reaching a suitable release position, he presses the bomb release button and takes his plane out of the dive by a pull-out. The bombs should then be released when the plane passes the angle which exactly compensates the curvature of the bomb path. Obviously this position must be determined automatically by an instrument which constantly measures flying altitude, flying speed, dive angle, etc., and from these factors computes the correct position of release for hitting the target. We have since learned that the German air force used a bombing method during pull-out, in a similar manner but with unsatisfactory technical arrangements and instruments, so that the demands for suitable tactics and accuracy were not fulfilled.

A detailed discussion of the proposed method showed that it would be worth making great efforts to realize the proposal. The task was therefore to study carefully the possibilities of constructing the instrument necessary for automatic precision bombing during pull-out. First the ballistic problems were studied so that a calculation of errors could be made. This implies, that the required accuracy of instruments and mechanisms could be estimated so that target misses should not be too frequent. It was found that demands on the measuring instruments would have to be much greater than could be met by existing instruments. For instance, the dive angle must be measured by a gyroscope with only a fraction of the marginal error of existing instruments. The altimeter and the speedometer should give correct data with much greater exactitude than standard instruments, even in the dive, where altitude and speed vary rapidly. In studying the detail problems therefore, it was deemed difficult, but not absolutely impossible, to overcome the obstacles in some way or other.

The author

Even at that early stage much interest was displayed in Saab's proposal by the experts of the Royal Swedish Air Force.

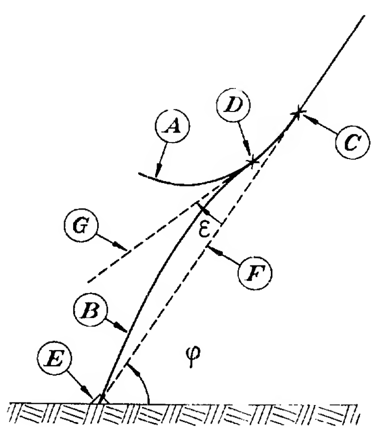
Projecting

In the spring of 1940, the author was commissioned by the Saab management to devote his whole time to the project for the purpose of first developing a trial instrument. As a collaborator I got Mr. Torsten Faxén, who for several years was directly responsible for a great part of the work in which his training as both a dive bomber and a graduated engineer was invaluable.

The first task was to find possible practical solutions of the difficult detail problems. Specialists in instrumental technics who were consulted considered that our demands for accuracy were too high under the circumstances. Therefore we had to approach the problems along entirely new lines. The situation in fact required a number of minor inventions. In this article

an account is given of the manner in which a part of the task was solved.

The usual method of measuring the altitude of airplanes is to measure the static air pressure around the airplane with some form of manometer. A certain air pressure indicates quite different altitudes when the air is cold and when it is warm, however. There may be deviations of + 10 %, which is far greater than we could accept. Speed measurement from airplanes is usually done by measuring the dynamic pressure of the air speed against a tube projecting forwards, the Pitot-static tube. In this case both the temperature and the static pressure of the air are essential factors, so that denser air gives higher pressure than thinner air at the same flying speed. One way of solving the problem would naturally be to measure air temperature and correct the indications of the altimeter and then correct the speedometer with allowance for temperature and pressure of the air. Actually such instruments have been designed, but they must necessarily be rather complicated. We found at the time, however, firstly, that the ballistic equations could all be converted so that altitude and speed were combined in a certain manner, and secondly, that the same combination could easily be calculated from the individual measurements of the static and dynamic air pressures alone. In this way we had found a simple guiding principle. It remained to achieve the desired accuracy of the measuring instruments themselves.



The special bombing method with release in the pull-out. A. The path of the plane in the pull-out. B. Bomb trajectory. C. Point of aiming. D. Point of release. E. Target. F. Aiming line. G. Direction of departure. φ Dive angle. ε Angle of divergence

We had great respect for the gyroscope problems. It was generally considered that the design and construction of good gyroscopes requires long experience. Our task made it necessary, however, to produce gyroscopes with many times greater accuracy than that of the corresponding airplane instruments. In this case too, the problem was studied exhaustively and by a few fundamental inventions we actually succeeded in realizing essential improvements in accuracy without detriment to the practical functioning of the gyroscopes.

Experiments

A period of experimenting began in the summer 1940, with the definite object of building a trial model of the bombing instrument. In a small laboratory which had been equipped for the purpose, we studied the possibilities of carrying out the various suggestions for the solution of the technical detail problems, and under Mr. Faxén the designing of the trial instrument began.

Many difficulties were encountered. The rapid changes of altitude and speed in the dive made great demands on the immediate reaction of the instrument. Various causes for time delays were therefore carefully studied, but only after producing a few interesting inventions of details did we obtain the basic conditions for achieving accuracy in spite of temperature changes, vibrations and external acceleration.

After a number of tests and improvements the prototype was ready. Laboratory experiments showed that this apparatus could measure the desired quantities with great accuracy and make computations of the formulae which had been deduced from the fundamental ideas. The laboratory experiments were arranged as nearly as possible in accordance with the desired functioning in the air. Thus the instrument was placed in an experimental jig, representing an airplane. By means of a hand lever this jig could be manoeuvered for "diving" and "pull-out" and there were also racks for suspending bombs, bomb selectors and such articles in the equipment, everything corresponding to the actual equipment of an airplane. The ground tests could therefore be carried out in a realistic and observable manner, and demonstrations arranged for the Royal Swedish Air Force strengthened the confidence in the new method. An airplane was put at our disposal and flight tests of the new instrument were started.

From the outset the air tests proved that the fundamental idea was correct, namely, that the pilot could accurately and easily direct his airplane towards the target in a medium steep dive and that the pull-out from the dive could be made in the calculated manner. Until these preliminary tests had been made, it was of course impossible to determine whether this bombing method would be practicable. The functioning of the trial instrument was first checked by electric measuring devices and lamps which registered the bomb release during pull-out. When the results appeared favourable, the first releases of practice bombs were begun. The result showed well concentrated hits, which promised well for the future.

Tests were continued for many months with numerous difficulties but also with many successes. It may be mentioned in short, that the altimeters and speedometers were actually found to give the desired high degree of accuracy of measurement in the dive and that the measurement of the dive angle proved to satisfy our demands on the gyroscope. Experience called for many alterations in details but the initial principles for the measuring instruments and design proved to be correct.

The first trial instrument was not entirely automatic. It carried out measurements and calculations automatically during dive and bomb release but it had to be served by a man between releases. It remained to devote considerable efforts to the further development of the instrument until completely automatic functioning was obtained and to design it in detail so that maximum reliability could be achieved. We drafted a design for such an instrument and suggested to the Air Force that it should be ordered for the Swedish light bombers. The suggestion was carefully studied and adopted.

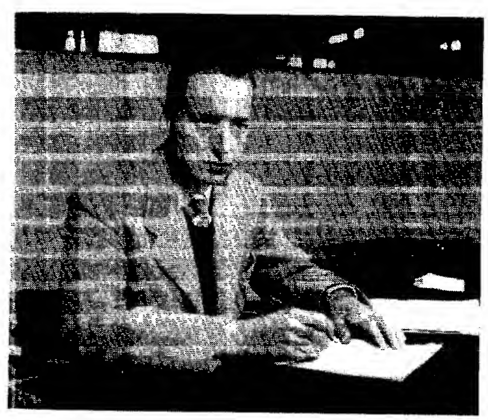
Serial manufacture

The little group of engineers who had hitherto taken part in the work were now set a more difficult task. Firstly, the number in the group had to be increased, that is, many beginners had to be taught, and secondly, we had to design reliable instruments for serial production. At that time Sweden's instrument industry was deluged with orders from the armed forces for the production of such precision parts as had earlier been procured from abroad. At Saab practically no experience had been gained in instrument design and manufacture: we therefore had to start by establishing a standard for designs, tools and machines. In six months the designing group was increased sixfold and the work was in full swing. An instrument workshop was started, production began, orders were placed with other industries and as early as the summer of 1941 the first instrument of a series production type could be tested in the air.

Air tests with series model instruments were carried on energetically along with thorough laboratory tests in severe cold, under vibration and of long-time use. The mechanisms frequently gave trouble and for a long time we made about 100 detail changes a month. We did not encounter any essential difficulties, however, and preparations for large scale deliveries proceeded.

During tests with these model instruments it was repeatedly confirmed that this method of bombing fulfilled the hopes we had made of it. It became clear that the pilots quickly learned the procedure, that the sighting method gave a clear view of the target, that release could be effected at the desired long distance and that accuracy was nevertheless very good. Everyone therefore was interested in having the instrument ready for practical service as soon as possible.

After quantity production deliveries had been in progress for some time, unexpected difficulties suddenly arose. In 1943 it became clear that the series-manufactured instruments were not as reliable as we had expected after the preceding tests. We at that time encountered a serious shortcoming in the gyroscopes. The rotor which ran at a speed of 15,000 r. p. m. had to run easily in the bearings to function satisfactorily in cold weather, but it was now found that the bearings



Mr. Torsten Faxén

did not stand the strain for as long as we had hoped. Certain other Swedish gyro instruments proved to have the same shortcoming; our fears that long experience was necessary for the construction of gyroscopes that are reliable in every respect and that such experience did not exist in Sweden seem to have been confirmed. After consulting all Swedish experts on the subject, however, Mr. B. Sylvan and E. Wallin, of Saab made an important laboratory discovery, which permitted all phases in the process of deterioration in the bearings to be investigated, and the two specialists very soon found an effective remedy.

Other shortcomings which reduced the reliability of the instruments in practical use were also studied and remedied, but the account of the gyroscope difficulties will suffice as an example of our designers' exceptional performance. Consequently we were soon able to introduce such changes that the complicated instruments with their 2,300 parts have always functioned perfectly ever since.

Economic factors

Another part in the development should be mentioned briefly, the economic side. The bomb sight is a complicated instrument and is therefore comparatively expensive. The price can even be estimated as several per cent of the airplane cost, but the expense has proved to be entirely justified by the increased value as a fighting unit which a light bomber gains by the use of this instrument. The very method of bombing which is made possible by the instrument reduces the risk from anti-aircraft fire during attack and so increases the lifetime of a bomber in war. The high degree of accuracy may be said to make one airplane so equipped to take the place of several machines and its economic value may be reckoned accordingly. Even in peacetime savings are apparent: the training period can be shortened or devoted to other important tasks, since bombing has been simplified. Another valuable quality, especially in peacetime, is the fact that the moderate dive angle makes for increased safety as compared with dive bombing in almost vertical dives.

When it became a question of carrying out this radical proposal for bombing, Saab's willingness to take risks was of the utmost importance. It was not merely a question of developing a single trial device by experiment but of initiating an entire department and placing considerable orders with many suppliers, before the deliveries could start and an economic result be attained. Saab had put many millions of kronor into the project up to the critical year 1943, when technical difficulties accumulated and placed a heavy responsibility on us as the designers.

Indirectly, Saab's work on the precision parts in the dive bomb sights have resulted in the establishment of a new department at Saab for the design and production of intricate mechanical devices, based on Swedish standards and suitable for the special demands made of such important material in the air. Our present apparatus department under the management of Mr. Faxén has expanded from the work with the bomb sights and today it handles hundreds of important devices on our airplanes.

In conclusion

one might perhaps venture to say that the new dive bomb sight has made possible a highly advanced bombing technique for Swedish aero-strategic conditions and that Saab contributed in this respect to heighten Swedish military strength during the latter half of the war.

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Intentional single engine stoppages after take-off with a maximum effect have proved that in these circumstances the airplane can be kept on a straight course at speeds as low as about 150 km/h, which allows a wide margin of safety, as the most suitable climbing speed is something like 225 km/h.

But can an absolutely new airplane be perfect, one might ask? Must there not be some need for improvement? There certainly are a number of details on the Scandia which are not ideal. The pilot's bad weather screens are not suitable. The rudder harmony is not quite satisfactory, as stated above. The pilot's seat might be more comfortable. But these are all matters which can and will be improved. When Saab's test pilots finally hand over the Scandia for mass production it will not only be a good airplane, it will be the best of its class, and the fact that it will be the best is largely dependent upon our effort; the Scandia itself possesses the prerequisite qualities.

Non-stop: Stockholm—Addis Ababa

Unique Aviation Performance with a Saab Safir

In May, 1947, the Swedish Count, Carl Gustaf von Rosen, Chief of the Imperial Ethiopian Air Force, performed a record non-stop flight from Stockholm to Addis Ababa. The flight was made in a Saab Safir, a plane with which Count von Rosen was very familiar from service flights in Ethiopia and from his visits to Sweden.
In the following article we have collected some data on the flight, chiefly from Count Rosen's own reports.

On Friday, May 9, at 04.00 hours the Safir took off from Bromma Airfield in Stockholm. The plane became airborne after 40 seconds, with a take-off run of about 900 m or five times the normal run. The take-off weight was exceptionally heavy however, being 1,500 kg as against 995 kg normally. After lifting, the plane climbed slowly, got on to its course and was soon out of sight the record flight had begun.

The idea of the non-stop flight originated with Count Rosen himself. It occurred to him while on a visit to Sweden connected with the delivery of the sixth Safir to Ethiopia. At first he intended to make intermediate landings in Rome and Cairo, but after checking the time schedules and flying distances he found that it would be possible to make the flight non-stop. Rosen also had unqualified confidence in the Safir and he considered the preliminary conditions to be entirely favourable for this long distance flight of 6,220 km which, if successful, would set a new long distance record for airplanes of this class. Airplanes are rated in classes based exclusively on the cylinder volume of the engine. The Safir's Gipsy Major 10 engine having a volume of 6.12 litres was rated in the 2 C class covering engines with a cylinder volume between 4 and 6.5 litres.

Preparations for the flight were only started a fortnight before the take-off and, as far as Rosen himself was concerned, consisted chiefly in obtaining permits for the flight across the countries enroute, that is to say, along the line Stockholm—Stolp—Vienna—Zagreb—Split—Sollum—Wadi Halfa—Khartoum—Addis Ababa.

The scheduled route would take Rosen between the Alps and the Carpathians and would thus enable him to avoid flights at high altitudes. Up to the last moment, however, it looked as though he would have to lengthen the air route as he was informed that he could not obtain a permit for flying across Russian-occupied territory within a sixmonth period. But the matter was settled satisfactorily after personal contact between Rosen and the Russian Ambassador in Stockholm. The latter was very interested in the flight and wished Count Rosen luck in his attempt.

Count Carl Gustaf von Rosen in the Safir just before taking off from Bromma

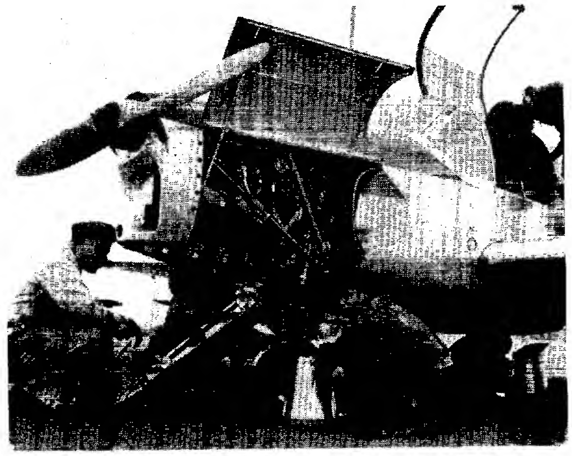
Preparations for the Safir were not very extensive. It was a series-assembled plane with a wooden propeller, the only equipment other than the standard being the extra fuel tanks which were placed in the two passenger seats of the cabin. The plane also had a directional gyro and a gyro horizon for blind flying. A few days before the flight a take-off test with a flying weight of 1,425 kg was made and the result was entirely satisfactory.

Preparations had been rushed through as much as possible to take advantage of the moonlight for night flying. There was a full moon on May 5, but it was impossible to complete preparations by that date. It was hoped therefore, that the half moon on May 9 would give sufficient light for orientation.

Count Rosen arrived at the airfield on the morning of the take-off refreshed by a 10-hour sleep. After the engine had been warmed, the tanks were filled and sealed. The total amount of petrol carried was 947 litres. The extra tanks filled the cabin, but Rosen had full freedom of movement after he had settled himself in the pilot's seat with his parachute and safety jacket. Provisions consisting of 10–12 sandwiches, a jar of grapefruit juice, a jar of pineapples and thermos bottles with tea, whortleberry soup and corned beef were stowed away. For emergency purposes phenedrin tablets were provided but Rosen did not intend to use these before he had completed at least 24 hours' flight, since he knew he could cover that distance without resorting to the use of drugs.

So the Safir rolled out and the take-off was excellent. Across the Baltic he kept to an altitude of 200 m and over Germany he rose to 400–500 m and finally over Africa he held an altitude of about 1,500 m. The speed varied between 180 km/h and 207 km/h. The weather was fine in

After the record flight the plane rolls out on the rain-soaked field of Addis



Native mechanics take the record-making machine in charge

Stockholm and held until off Crete, where Rosen encountered clouds and darkness. Over the Libyan desert sand storms were raging, and for ten hours he was obliged to trust entirely to his instruments in blind flying. Thus, the moonlight was of no assistance, and at Wadi Halfa where he had to change his course he had to take his bearings in the dark and without ground control. In the hot sand storm the temperature of the oil rose to 95° C, and the oil tank being located in the cabin, the heat became somewhat unpleasant. On the whole, the ten hours of blind flying in pitch darkness, without moon or stars, in a hot, stormy atmosphere were far from pleasant Rosen reported in a cable.

From Khartoum onwards to Addis Ababa the weather was fairly good, however, apart from some violent rainstorms in the Ethiopian mountains. Here he also experienced icing of the carburetor as had been the case over the Baltic and the Mediterranean, but this was easily remedied with the help of warm air. The large additional load made the plane tail heavy during blind flying, but otherwise the conditions were normal. The instruments worked perfectly and the windshield was clean and clear all through the flight.

At 11.01 hours Swedish time on Saturday morning, 30 hours and 52 minutes after the take-off, the Safir landed on the airfield of Addis Ababa. In spite of violent thunder storms many people had gathered to welcome the record-making pilot. After the plane had taxied to a stop on the rain-soaked field, Count Rosen stepped out, by no means tired and in good spirits without having had to use phenedrin to receive his wife's welcoming kiss.

General Nordenskiöld pins the unique decoration to Count von Rosen' tunic

The ground staff who took the plane in charge, found that there were 15 litres of oil and 86 litres of petrol left. Generally speaking, the plane was in excellent condition and did not develop any oil spatter.

When Count Rosen reported to the Emperor later in the day he could do so in the full knowledge that his feat had demonstrated that the Safir fully complied with the recommendation he had given it.

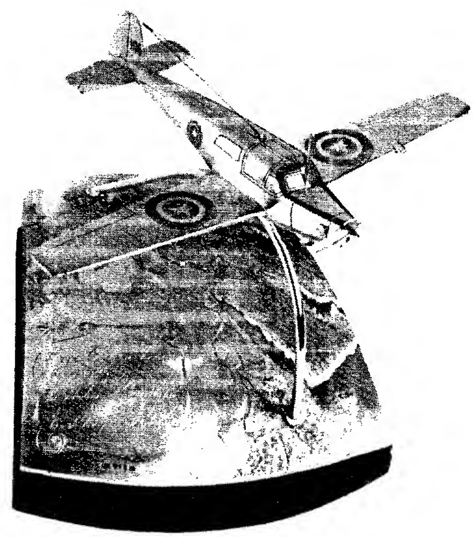
He exhibited great modesty concerning his own performance and jokingly mentioned that the record flight was no more trying than a night's dancing. The fact that the flight was so successful however, may chiefly be attributed to Rosen's extraordinary skill as a pilot and his long experience on tropical long distance flights.

In recognition of Rosen's feat Saab had a souvenir made a model Safir mounted on an arc showing his route on a conventional map with an inscription in the bottom left hand corner. It was executed in silver and is a fine example of Swedish silverwork.

The souvenir was presented to Count Rosen during a visit to Saab in October, 1947. He was in Sweden at that time to arrange and lead a flight of 16 Saab-17's to Ethiopia which had purchased them from the Royal Swedish Air Force. Incidentally these light bombers were the first in a series of various military aircraft which Saab delivered to the Royal Swedish Air Force during and after the war.

During his visit to his home country Count Rosen was also awarded a rare distinction, the Gold Medal with Wings of the Royal Swedish Aviation Club a mark of distinction which had never been awarded previously. The medal was presented by the Commander of the Royal Swedish Air Force, General Nordenskiöld, who paid homage to the pilot for his world record performance.

In his speech of acceptance for this distinction Rosen pointed out that the honour was not his alone, but was also due to a great extent to Saab the firm that had built the Safir which had made the flight possible, and he thereupon called for cheers for the airplane and its creator.



Saab's memorial gift—a model in silver of the Safir flying across a symbolic map of the flight route

Contd. from page 16

advanced; one and a half years later particulars were given of "the first Swedish-designed multi-engined airplane" i. e. the Saab-18A. The phrase quoted was a slight exaggeration of the actual facts, however a three-engined plane having been designed many years earlier, but it may be regarded as a white lie since that design was never put into production. The Saab-18A is equipped with two Pratt & Whitney/SFA TWC-3 engines of each 1,050 HP.

One year later Saab brought out a new version of the same plane, the Saab-18B, which is equipped with much more powerful engines than the 18A, namely, the liquid-cooled Daimler Benz DB 605B—engine, developing 1,475 HP.

In 1945 the production of the pusher fighter Saab-21 and in 1946 of the elegant light aircraft Saab Safir were announced. In 1946 also, the transport aircraft Saab Scandia made its initial test flight. In 1947, finally, the jet propulsion type of the Saab-21, known as the Saab-21R, was completed, and a product of quite another character was announced, namely, a small high quality motor car, at present called the Saab-92.

These types will be described later in detail in our journal, and consequently this brief retrospective survey may be concluded. This is far from being the case as regards progress in the Swedish aviation industry, however, and it is hoped that an opportunity will be afforded later on to publish particulars of future plans.

U. D. C. 629.138.5.002.2 Saab Scandia

Bjurströmer, B: *A few aspects on the design of Saab Scandia.* Saab Sonics no. 1 1948 p. 4—8.

The qualities and features were carefully determined in the projection phase. Flying safety was the fundamental principle. Wing loading of vital importance for flying qualities. Thorough study of the wing. The low-wing design provides a number of advantages. Landing gear retracted forwards. Air-cooled radial engines preferable to liquid-cooled engines. The airplane meets the requirements of the U. S. Civil Air Regulations. The wing is built with three spars. Control surfaces of Friese Type. Control surface balance studied in the wind tunnel. Anti-icing protection by heated air. Test flights have shown the Scandia's qualities to surpass all expectations.

U. D. C. 629.13.001.1 Saab Scandia

Smith, C J: *The Scandia in the air.* Saab Sonics no. 1 1948 p. 9—10.

The cockpit is practically and sensibly equipped. The pilot of the Scandia has direct contact with the members of the crew. Telephone connection to the air hostess. Predictions of aerodynamical experts were entirely confirmed in the test flights. The airplane is under complete control even at low speeds. Ample surplus output at take-off. Excellent flying qualities when flying with one engine.

U. D. C. 629.13(09)

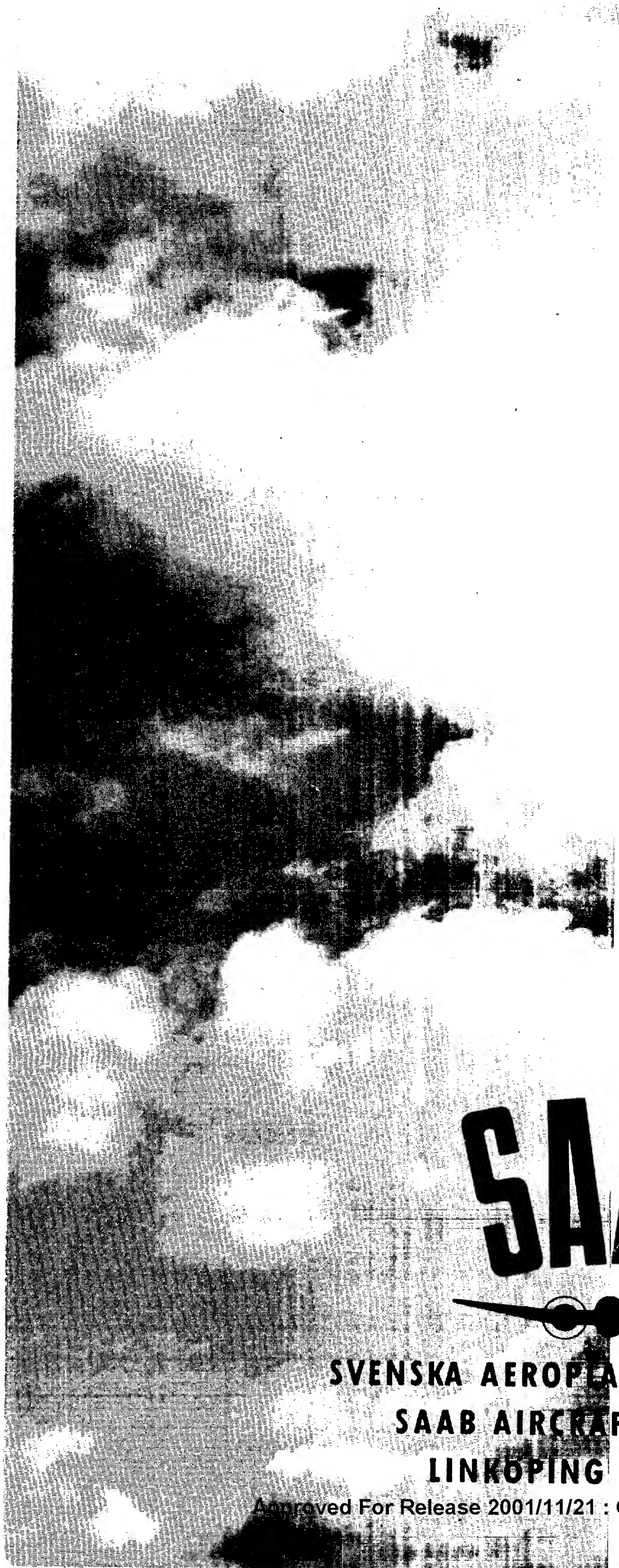
Nordquist, E: *A Technical review of Saab progress.* Saab Sonics no. 1 1948 p. 14—16.

A Short History of Aircraft production at AB Svenska Järnvägsverkstäderna and Saab Aircraft Company.

U. D. C. 623, 428, 82

Wilkenson, E: *How Saab developed a new bomb sight.* Saab Sonics no. 1 1948 p. 17—21.

Bomb release problems from various angles. Dive bombing. New release method in medium steep dives. The same sight is used as for the forward firing weapons. The bombs are automatically released in the pull-out. The possibilities of designing an automatic bomb release instrument are studied. Great demands on measuring instruments. Gyroscopes of greater accuracy than formerly necessary. Experiments begin in summer, 1940. The fundamental idea of the new method proves correct. The first trial instrument not entirely automatic. The Air Force orders new bomb sights. Mass production begins. Designing staff personnel increases sixfold in half a year. Instrument workshop established. Flying tests combined with exhaustive laboratory tests. Serious gyroscope problem. The shortcoming is revealed in laboratory tests and remedied. One instrument consists of 2,300 parts. Economic angle. Relative cost of the new bomb sight is balanced by the increased fighting efficiency of the planes. Accuracy in hitting target is increased and risk of hits from anti-aircraft artillery reduced. Saab showed great willingness to risk money in developing the idea. Saab's apparatus department makes important airplane devices in addition to bomb sights. The new bomb sight has made good bombing tactics possible.



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